THE ORIENTAL SPECIES OF THE GENUS *MUSCA* LINNAEUS.

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(Plates XXIX—XXXIII.)

In several recent papers one of the writers has recorded his studies of all the existing types of the species of the genus *Musca*, and as a result of this work it has been possible to accord the species their final names. In the present paper, the second [1] of a series on the Oriental Muscidae, we propose re-describing all those species of *Musca* at present known to us from the Region. It should be noted, however, that this paper is not meant to be final, but rather a preliminary contribution with that end in view. Although our knowledge of the Oriental species is much more complete than that of those of other Regions, further study of fresh material of a few of the rarer species is necessary before systematic work on the family can be completed.

Although the primary object of this paper is a systematic study of the species, we have endeavoured to make it of practical use to medical and veterinary officers to whom a knowledge of the species is of the first importance. Keeping this object in view it is necessary to explain shortly some of the terms used in the keys and descriptions.

EXTERNAL CHARACTERS OF USE IN DETERMINING SPECIES.

General Colour.—In the first place it should be noted that the majority of the species of this genus are greyish flies with well-marked dark stripes on the dorsal surface of the thorax. The males of three species, *vitripennis, tempestiva* and *albina* are, however, metallic and thoracic stripes are absent. The females of *tempestiva* and *albina* are not metallic and have well marked thoracic stripes; the female of *vitripennis* has a distinct metallic sheen but also has stripes.

Head.—The males of the majority of the species are sub-holoptic, the front, or area between the eyes, being very narrow. The males of the three species *domestica, fletcheri* and *inferior* are dichoptic, the front being about half the width of an eye. In this type of front the eyes are referred to in the key as "widely separated," (Pl. XXIX, fig. 3). In some males, *e.g. nebulo, sorbens* and *spinohumera*, the front, though still dichoptic, is much narrower, varying from one-fifth to one-eighth the width of an eye, in this type the eyes are referred to in the key as "well separated," (Pl. XXIX, fig. 4). In the majority of the species the front is very narrow, with the eyes almost approximated in the middle line. The eyes in this type are referred to as "narrowly separated," (Pl. XXIX, fig. 5).

[1] The first is "A revision of the Sarcophaginae of the Oriental Region" by the Junior Author, (*Rec. Ind. Mus.* XXVI, p. 193). It is hoped that the remaining groups will be revised by the end of 1925.

In the males of a few species, and in one female, the eyes are hairy. In the male *vitripennis* and in both sexes of *dasyops* the hairs are very numerous and can easily be seen with a pocket lens. In the males of *gibsoni* and *hervei* the hairs are very scanty and can only be seen with a high power. The remaining species of the genus have bare eyes. In some males the upper and middle facets of the eyes are distinctly larger than the remainder. This character is well seen in the male of *xanthomelas*.

There are very few reliable characters to be found on the head of the females. The front is always wide, and its width in relation to the width of an eye is of some use in separating the species, but it should be remembered that there is considerable variation in different specimens of the same species. The parafront, the sclerite situated between the outer margin of the frontal stripe and the inner margin of the eye, always bears a number of bristles, (parafrontal bristles, often called orbital bristles), arranged in one, two, three or more rows. In many of the species in which the bristles appear to be arranged in one row it should be noted that there is a second row commencing at the lower third of the frontal stripe; this arrangement is seen in *domestica*. In the female of *conducens*, however, there is a single row of bristles down to the lower end of the frontal stripe. In *Musca bezzii* there are three rows of bristles, while in the female *albina* there are four and even five. Here again it is necessary to point out that there is considerable variation in the number and arrangement of these bristles in the same species. The characters of the frontal stripe, the narrow dark band in the middle of the front, are of doubtful use in separating the species; the width varies considerably and if the fly has been pinned before it has hardened the whole front is apt to collapse and the stripe may appear very narrow; in the female *albina* the frontal stripe is strikingly narrow and the eyes widely separated.

In the majority of the species the palp is black, but in *conducens*, *planiceps*, *inferior* and *crassirostris* it is yellow or yellowish. This character together with others is of considerable use in recognizing these species.

The structure of the proboscis should always be noted, especially in specimens in which it is partially or completely extended. On examining the extended proboscis of *domestica* or *nebulo* it will be noted that the mentum or posterior wall of the labium is not markedly dilated and does not project downwards to form a bulbous portion, (Pl. XXIX, fig. 13), this type of mentum is common to the majority of the species, which are not biting flies. An enlarged and strongly chitinized mentum indicates that the species is either on the way to becoming a biting fly or is one already. This change in the structure of the mentum is seen in *conducens* which, though a blood feeder, is not a true biting fly. The enlargement of the mentum is associated with a diminution in the number of the prestomal teeth and increase in their size; in *conducens* the prestomal teeth though reduced in number and considerably enlarged are not strong enough to scratch the skin in order to draw blood. In *Musca planiceps*, however, the teeth are used to scarify the skin and this species is a true biting fly. This type of proboscis has reached its highest de-

velopment in *M. inferior* and *M. crassirostris*, (Pl. XXIX, fig. 14); the mentum and teeth have become strongly chitinized and there is a well developed interdental armature. The proboscis in these species is a most efficient scratching organ. It is however quite an erroneous idea to think that the proboscis of *crassirostris* is anything more than a special adaptation to the blood sucking habit. Structurally it is exactly similar to the proboscis of *domestica*. If the proboscis of *crassirostris* is examined with a hand lens, especially when the labella are everted and the teeth exposed, it is suggestive of a piercing organ, (*Stomoxys*), but there is no doubt whatever that the proboscis does not penetrate the skin.

Thorax.—The number and arrangement of the bristles, (macrochaetae), on the thorax is of considerable use in separating the species, but it should be remembered that they are very variable and if used alone are sure to lead to errors in determination, (Pl. XXIX, figs. 7 and 10).

In *Musca domestica*, the type of the genus, there are normally three presutural dorso-central bristles, the most anterior the smallest, and four posterior dorso-central bristles. There are no presutural acrostichal bristles and only one behind the suture at the posterior end of the scutum. This number and arrangement is common to most of the species and is well seen in *M. bezzii*, *pattoni*, etc. It is not uncommon to find specimens in which the first presutral dorso-central bristle is absent or greatly reduced; occasionally one of the post-sutural dorso-central bristles also is absent or reduced in size. In a few species, *e.g.*, *planiceps*, *senior-whitei* and *crassirostris* there are only two presutural dorso-centrals and only two post-sutural, the most anterior of the latter being very small, hardly to be called a macrochaete. The reduction of these bristles is even more marked in *M. fletcheri* and *M. inferior* in which the two presutural dorso-central bristles are very small and hardly to be called macrochaetae, and there are only two strongly developed post-sutural bristles, but the extreme limit in the reduction of bristles is seen in *M. albina* in which there is only one post-sutural dorso-central and the acrostichal bristles are entirely absent. Further, in this species the sterno-pleural bristles are also absent. The arrangement of the bristles of the thorax is seen in Plate XXIX, figs. 7 and 10.

Abdomen.—On examining the abdomen of a species of *Musca* it will be noted that there are only four visible tergites. If the abdomen is cleared in potash and mounted flat after slitting the tergites in the middle line it will be noted that there are six stigmatic openings in the male and five in the female. The apparent first tergite has two stigmatic openings, and it is evident that it represents two tergites fused together. The anterior strip may be either the true first tergite or the second, making the apparent first tergite either the true second or the true third. The sternite corresponding to the apparent first tergite evidently belongs to the larger part of the latter.

It is not possible to express a final opinion on the number of tergites and sternites; we do not know for certain yet whether the true first tergite has entirely disappeared or whether it is reduced and is represented by the slip of chitin at the anterior end of the first tergite. The apparent first sternite evidently belongs to the larger part of the apparent first tergite. Extensive comparative and developmental

studies are necessary before it can be affirmed that an explanation applicable to one genus of the Muscidae Calyptratae is true for another.

To avoid any confusion the word "apparent" is to be understood before the words "tergite" and "sternite" in the keys and descriptions.

The colour of the tergites and sternites is of very considerable value when taken in conjunction with other characters for separating the different species. Here again there is of course much variation but each species has a more or less characteristically marked abdomen. The sternites are orange in the majority of species, but in some they are black (*bakeri, hervei* and *lucens*; Pl. XXIX, figs. 1 and 2). In *hervei* the ventral margins of the tergites adjacent to the sternites are also black, (Pl. XXIX, fig. 2). In some of the species it is not uncommon to see the first tergite black and the others orange, as is the case in *conducens*.

So far we have not been able to discover any reliable characters in either the male or the female hypopygium for separating the species. The differences are so small and there is so much variation that we would not recommend anyone to attempt to use these structures in separating species.

Venation.—The venation of *Musca* is illustrated in Plate XXIX, fig. 8. In the majority of the species cell R $_5$, (1st posterior), is narrowly open; in *M. lucidula* it is closed. There is some variation in the bend of vein M_1+_2, (4th longitudinal), it may be rounded as in *tempestiva* or more or less angled as in *domestica*. The position of the medio-cubital, (posterior), cross-vein in relation to the bend is somewhat variable.

The most valuable characters on the wing are to be found in the number and arrangement of the hairs on the posterior border of the base of the radial vein, and in the presence or absence of the small bristles on the ventral side of vein R $_{4+5}$, (Pl. XXIX, fig. 6). The hairs on the base of the radial vein are fairly constant for each species and are most useful in separating closely allied species. The small bristles on the ventral side of vein R $_{4+5}$ may be limited to the base of the vein only, (*domestica*), or they may extend in a row up to and beyond the radio-medial, (anterior), cross-vein, (Pl. XXIX, fig. 6). The number of hairs and the presence or absence of the bristles on vein R $_{4+5}$ and their arrangement are largely used in separating the species in the keys. Occasionally the hairs and bristles may be entirely rubbed off, and if there is any doubt as to their presence or absence the wing should be removed, placed in absolute alcohol for a few minutes, then in clove oil, and later mounted in canada balsam on a slide ventral side uppermost. A row of scars, (Pl. XXIX, fig. 9), on the ventral side of the vein extending up to and beyond the radio-medial cross-vein will leave no doubt as to whether the species possesses these bristles or not. It should be noted, however, that there are normally some circular pit-like areas on the ventral side of vein R $_{4+5}$ which may be mistaken for bristle-scars; they are not so numerous as the latter and do not extend in a continuous row up to and beyond the radio-medial cross-vein.

If the beginner makes himself familiar with the characters noted above he should have no difficulty in using the keys. Occasionally one finds an atypical specimen which it is not possible to name, it should be submitted to an expert. Lastly the beginner should never attempt to name a damaged or a greasy specimen. The keys have been tested and will be found, we hope, of considerable use in determining the Oriental species at present known to us. In using them, and in consulting the descriptions, all examinations should be made with the head of the specimen directed towards the observer. The figures of abdomens in Plates XXX—XXXIII are drawn in this position also. The appearance of the abdominal pattern if viewed in the reverse direction is usually quite different. The drawings of the abdomens on Plates XXX—XXXIII have been executed by Mrs. Patton and the junior Author.

Key to the males of the Oriental species of the genus Musca.

1.	Species with metallic thorax and no stripes	2
	Species without metallic thorax and with dark stripes ..	4
2.	Eyes densely pubescent. 1st abdominal tergite yellow with a broad metallic green stripe; 3rd tergite with a large greyish patch. Kashmir	*vitripennis.*
	Eyes bare	3
3.	Sternopleural bristles absent. Eyes well separated. 1st abdominal tergite light orange with a median basal dark spot; 2nd tergite with a similar spot produced forwards to form an incomplete median stripe; 3rd tergite similar; 4th tergite with a light median silvery patch and admedian dark spots. Ceylon; Baluchistan ..	*albina.*
	Sternopleural bristles present. Eyes closely approximated. 1st abdominal tergite black. Kashmir ..	*tempestiva.*
4.	Eyes hairy, densely or sparsely so	5
	Eyes bare	7
5.	Eyes densely hairy. Thorax with two broad black stripes. 1st abdominal tergite black with blue admedian spots on posterior border. China	*dasyops.*
	Eyes with a few scattered microscopic hairs	6
6.	Thorax with four broad black stripes. 1st abdominal tergite dark brown except for narrow posterior bands and margins of tergites, which are orange. Indian Hills..	*gibsoni.*
	Thorax with four broad black stripes. 1st abdominal tergite with two small round silvery admedian spots. China; Shillong; Simla	*hervei.*
7.	Thorax with two broad black stipes	8
	Thorax with four broad black stripes	11
8.	Eyes narrowly separated	9
	Eyes well separated	10
9.	1st abdominal tergite mainly orange, the anterior margin black; 2nd tergite with a black median stripe, well marked adjacent and marginal silvery stripes; 3rd tergite similar with a much marrower dark median stripe. Sternites orange. South India ..	*villeneuvi.*
	1st abdominal tergite entirely black. Sternites black. Ceylon	*lucens.*
10.	Thorax bluish. 1st abdominal tergite entirely dark orange to black	*vetustissima.*
	Thorax greyish. 1st abdominal tergite orange, sometimes dark orange with a dark median stripe	*sorbens.*
11.	Squamae with hairs on their upper and anterior surface. 1st abdominal tergite dark brown to black with bluish grey patches on posterior border	*inferior.*
	Squamae bare	12

12.	Eyes widely separated, front from a third to about half width of an eye	13
	Eyes well separated, front from one-fifth to one-eighth an eye	14
	Eyes either narrowly separated or closely approximated ..	18
13.	1st abdominal tergite mainly black, the lower border narrowly orange with yellow pollinosity on each side of the median black stripe. Vein R 4+5 with ventral bristles extending to beyond the radio-medial cross vein. Root of radial-vein with five or six hairs. Carnatic Coast	*fletcheri.*
	1st abdominal tergite mainly orange with a broad median black stripe and black anterior margin. Vein R 4+5 with a few bristles on ventral side at base, not extending to cross-vein. Root of radial vein with one small hair. Extreme North India and possibly at large Ports	*domestica.*
14.	Vein R 4+5 with a row of bristles on ventral side extending to beyond the radio-medial cross vein. Root of radial vein with five, sometimes seven, small hairs. 1st abdominal tergite orange to black with a narrow brown band at lower border and margins; 2nd tergite with a broad median black stripe extending some distance along anterior border of tergite. Indo-Gangetic Plain; Ceylon	*spinohumera.*
	Vein R 4+5 with a few basal hairs ventrally but none extending towards the radio-medial cross-vein ..	15
15.	1st abdominal tergite entirely dark orange or black; 2nd tergite with a broad median black stripe widening out anteriorly and posteriorly, silvery spots at side of stripe and at margins of tergite well marked. Eyes with distinct area of enlarged facets. Plains of India ..	*xanthomelas.*
	1st abdominal tergite mainly light orange	16
16.	2nd abdominal tergite with a narrow median black stripe and silvery margins; 3rd tergite similar	*nebulo*, (var.)
	2nd abdominal tergite orange with a broad median black stripe	17
17.	2nd abdominal tergite light orange with a broad median black stripe and silvery margins; 3rd tergite orange with a narrower median black stripe, admedian dark stripes and broad intervening and marginal silvery stripes; 4th tergite orange with silvery lateral stripes. Throughout Oriental Region	*nebulo.*
	1st and 2nd tergites very similar to those of *nebulo*, but 3rd and 4th tergites with dark brown admedian and much darker greyish intervening stripes. Throughout Oriental Region	*vicina.*
18.	Sternites black	19
	Sternites orange	20
19.	Ventral margin of tergites close to sternites also black. 1st abdominal tergite dark brown or black with two small admedian spots of silvery colour near posterior border. Eyes minutely pubescent. S. China; Burma; Assam; Simla	*hervei.*
	Ventral margin of tergites close to sternites orange. 1st abdominal tergite black without any silvery spots. Philippine Islands ...	*bakeri.*
20.	Vein R 4+5 with ventral bristles to beyond the radio-medial cross vein	21
	Vein R 4+5 with ventral bristles at base only.. ..	25
21.	1st abdominal tergite mainly black	22
	1st abdominal tergite either light or dark orange ..	23

22. 1st abdominal tergite except for a narrow orange band at the postero-lateral margin black ; 2nd tergite orange with a broad median black stripe and admedian and lateral silvery stripes. Root of radial vein with seven hairs. Indian Hills .. .. .. *bezzii.*

1st abdominal tergite mainly black except for a narrow bluish white band on posterior border ; 2nd tergite with a broad median black stripe and two narrower black admedian stripes. Root of radial vein with never more than two hairs. Plains of India, Calcutta ; Malaya ; Java *senior-whitei.*

23. Proboscis with mentum large and well chitinized, (and if labella everted prestomal teeth well seen), 1st abdominal tergite light orange, anterior margin dark brown and a dark brown spot at middle of posterior border ; 2nd tergite light orange with well marked yellow pollen, and a small dark median spot at the posterior border sometimes extending forwards as a faint median stripe ; 3rd tergite similar, the stripe more distinct .. .. *planiceps.*

Mentum neither markedly nor strongly chitinised .. 24

24 2nd tergite dark orange with a broad median black stripe, adjacent and marginal silvery spots ; 3rd tergite very similar but median stripe with narrower adjacent and marginal silvery spots, the latter forming stripes. Java ; Assam ; Calcutta .. .. *illingworthi.*

2nd tergite light orange with a broad median black stripe, broad adjacent stripes and large marginal silvery spots ; 3rd tergite very similar but median black stripe narrower Plains of India.. .. .. .. *pattoni.*

25. Palpi light orange. Mentum very large and strongly chitinized, forming a distinct bulb at the base of the proboscis. Abdomen olive green ; 1st tergite mainly black with a median black stripe, (in some specimens the tergite is mainly olive green, only the anterior border being black), 2nd tergite with a narrow median black stripe extending some distance along the anterior border of the tergite forming a narrow band ; 3rd tergite with a narrower median black stripe. Throughout Oriental Region .. .. *crassirostris.*

Palpi black, mentum not large and chitinized 26

26. 1st tergite mainly light orange 27

1st tergite either dark orange or black 28

27. 1st tergite except for a dark median anterior patch entirely orange ; 2nd, 3rd and 4th tergites orange except for a faint dark median stripe on 2nd and 3rd. Widely distributed in Region .. .. *ventrosa.*

1st tergite with or without a complete black median stripe ; 2nd tergite dark orange with a broad median black stripe and silvery stripes on each side, *no marginal silvery spots* ; 3rd tergite similar but with well marked silvery stripe on each side of the median dark stripe and at the margins. South India ; Ceylon ; Burma .. *yerburyi.*

28. 1st tergite dark orange ; 2nd light orange with yellowish white pollinosity and a broad black median stripe ; 3rd tergite similar but with a narrower dark median stripe. Widely distributed in Region .. .. .. *conducens.*

1st tergite black 29

29. Inner thoracic stripes in front of suture as broad as the outer pair. 2nd tergite orange with a broad median black stripe extending along the upper border of the tergite forming a broad median band ; 3rd tergite greyish with a narrow black stripe and dark brown admedian stripes. Kashmir .. .. *prashadi.*

Inner thoracic stripes in front of suture much narrower than the outer pair. 2nd tergite dark orange with a broad median stripe and silvery adjacent and marginal spots ; 3rd tergite similar but median stripe narrower. S. India ; Ceylon .. .. *pulla.*

Key to the females of the Oriental species of the genus Musca.

1.	Thorax and abdomen with metallic sheen, the former with four black stripes. 1st abdominal tergite black ..	*vitripennis.*
	Thorax without metallic sheen and with either two or four dark thoracic stripes	2
2.	Eyes densely hairy. 1st abdominal tergite black with admedian bluish white spots on posterior border ..	*dasyops.*
	Eyes bare	3
3.	Sternopleural bristles absent	*albina.*
	Sternopleural bristles present	4
4.	Thorax with two black stripes	5
	Thorax with four black stripes	8
5.	Stripes on thorax very broad and not divided in front of the suture	6
	Stripes not quite so broad and always divided in front of the suture	7
6.	1st abdominal tergite orange, the anterior margin black, and with a black median stripe; 2nd tergite orange with silvery reflections and a broad median black stripe. Sternites orange	*villeneuvi.*
	1st tergite light orange without any markings; 2nd tergite similar with some blue reflections. Sternites black ..	*lucens.*
7.	Thorax greyish. Abdomen greyish with dark brown and yellowish stripes. 1st tergite dark brown	*sorbens.*
	Thorax bluish. Abdomen bluish with black stripes and bands. 1st tergite black	*vetustissima.*
8.	Sternites black	9
	Sternites orange	10
9.	Ventral margins of tergites adjacent to sternites also black. 1st tergite black with bluish white admedian spots ..	*hervei.*
	Ventral margins of tergites adjacent to sternites orange. 1st tergite dark brown with bluish white admedian spots on posterior border	*bakeri.*
10.	Vein R $_{4+5}$ with bristles ventrally to beyond the radio-medial cross vein	11
	Vein R $_{4+5}$ without bristles beyond the base ventrally ..	19
11.	Squamae with hairs on upper surface. 1st tergite orange with two large round admedian bluish white spots on the posterior border	*inferior.*
	Squamae bare	12
12.	1st abdominal tergite mainly black	13
	1st abdominal tergite mainly orange	14
13.	1st abdominal tergite black with two admedian greyish-blue spots. 2nd tergite similar but with larger marginal greyish-blue spots; Root of radial vein with seven hairs. Parafrontal bristles in three rows. Large species	*bezzii*
	1st abdominal tergite also black with greyish-blue admedian spots, forming a partial grey posterior band; 2nd tergite brown with dark median stripes and intervening and marginal greyish-blue spots or stripes. Root of radial vein with four hairs. Parafrontals with one row of bristles. Smaller species	*senior-whitei.*
14.	Presutural dorso-centrals small. 1st tergite dark orange with a broad median black stripe and large bluish white spots on each side on the posterior border, the anterior margin of the tergite black. 2nd tergite orange with a narrow median dark brown and admedian triangular stripes and marginal yellowish spots not quite reaching the anterior border. Root of radial vein with five hairs. Mentum large and strongly chitinized ..	*fletcheri.*
	Presutural dorso-centrals well developed	15

15. 1st tergite orange without any definite markings except a median dark spot on posterior border; 2nd tergite orange with a dark median stripe, rest of tergite yellow pollinose. Root of radial vein with one hair. Mentum large and strongly chitinized .. .. .. *planiceps.*

    1st abdominal tergite dark orange with black stripes and bands. Root of radial vein with from one to seven hairs. 16

16. Root of radial vein as a rule with three hairs 17

    Root of radial vein either with one or seven hairs .. 18

17. 2nd, 3rd and 4th tergites mainly greyish white, the two former with dark median stripes well-marked, and well-marked admedian spots, their bases spreading out and forming posterior bands .. .. .. *gibsoni.*

    2nd, 3rd and 4th tergites mainly dark orange with sharply defined dark and white bands and stripes .. .. *illingworthi.*

18. Root of radial vein with one, rarely with two or three hairs .. .. *pattoni.*

    Root of radial vein with five to seven hairs .. .. *spinohumera.*

19. Palps light orange. Mentum large and strongly chitinized forming a characteristic black bulb at the base of the proboscis. Abdomen olive green .. .. *crassirostris.*

    Palps black. Mentum not enlarged to form a bulb at the base of the proboscis 20

20. 1st abdominal tergite either wholly or mainly black .. 21

    1st abdominal tergite either light or dark orange .. 22

21. 1st tergite entirely black; 2nd olive green with a broad black median stripe expanding anteriorly and with a narrow posterior black band. Parafrontals in one row. Small species .. .. *tempestiva.*

    1st tergite black with large bluish grey patches on each side of middle line of posterior border forming a more or less complete band; 2nd tergite olive green with narrow dark median and admedian stripes. Parafrontals in three rows. Large species .. .. *prashadi.*

22. 1st abdominal tergite almost entirely light orange .. 23

    1st abdominal tergite dark orange 25

23. 1st abdominal tergite light orange except for the extreme anterior border in the middle line, which is black. Remaining tergites orange without any markings, (sometimes 2nd and 3rd with a faint median dark stripe), thorax dark bluish .. .. .. *ventrosa.*

    1st tergite light orange except extreme anterior border in the middle line; remaining tergites with dark and light stripes well marked. Thorax greyish or bluish .. 24

24. Tergites mainly bright orange; 2nd and 3rd tergites with a dark median stripe and well marked silvery stripes on each side and at the margins. Thorax bluish .. *yerburyi.*

    All abdominal tergites not so conspicuously orange but much more silvery; 2nd tergite with extensive silvery markings, a broad median black stripe, dark admedian stripes and silvery margins; 3rd tergite very similar. Thorax grey .. .. *nebulo.*

25. Inner thoracic stripes in front of the suture much narrower than behind it and narrower than the external stripes; 2nd tergite dark orange with a broad median black stripe and silvery admedian and marginal stripes, and a broad dark basal band .. .. *pulla.*

    Inner thoracic stripes in front of the suture as wide as behind it, and as wide as the external pair 26

26. Parafrontal bristles in one row throughout .. 27

    Parafrontal bristles in one row up to the lower third of the frontal stripe, thence in two rows .. 28

27. 2nd abdominal tergite olive green with a dark median stripe expanding anteriorly to form a partial band, and posteriorly to form a complete band along the posterior margin of the tergite ; 3rd tergite olive green with a narrower median stripe and a very narrow posterior dark band .. *conducens.*

2nd tergite orange with a median dark stripe expanding posteriorly to form a dark band, and with silvery margins ; 3rd tergite similar but median stripe and band narrower .. .. *xanthomelas.*

28. Parafrontals narrowing distinctly towards vertex .. *domestica.*

Parafrontals not narrowing towards the vertex .. *vicina.*

Short description of the Oriental species.

In the descriptions of the species no attempt is made to give details but only those characters are noted which are of use in identification.

The synonomy is now complete and the types of the species marked with an asterisk have been examined by the senior author.

Musca Linnaeus.

Byomya R.-D. ; *Plaxemyia* R.-D. ; *Placomyia* R.-D. ; *Philaematomyia* Aust. ; *Pristirhynchomyia* Brun.; *Ptilolepis* Bezzi ; *Eumusca* Towns.; *Promusca* Towns.; *Viviparomusca* Towns.; *Awatia* Towns.; *Lissosterna* Bezzi.

Musca domestica L.

? *Musca aurifacies* R.-D.; ? *Musca riparia* R.-D.; ? *Musca stomoxidea* R.-D.; ? *Musca campicola* R.-D.; ? *Musca vagatoria* R.-D.; ? *Musca hottentota* R.-D.; ? *Musca vicina* R.-D. *nec* Macq.; ? *Musca rivulans* R.-D.; *Musca corvina* F.; *Musca ludifica* F.; *Musca umbraculata* F.; ? *Musca frontalis* Rond.; * *Musca minor* Macq.; * *Musca australis* Macq.; ? *Musca lateralis* Macq.; ? *Musca chiliensis* Macq.; ? *Musca pellucens* Meig.; * *Musca pampasiana* Big.; * *Musca vicaria* Wlk.; * *Musca antiquissima* Wlk.; * *Musca calleva* Wlk.

Male.—Front wide, nearly half that of an eye ; frontal stripe broad, black, with a slight waist about the middle ; parafrontals narrow, black with bluish sheen, grey at lower border ; cheeks silvery or yellowish.

Four thoracic stripes, each as wide as the front, complete, *i.e.*, extending the whole length of the scutum.

Abdomen (Pl. XXX, fig. 1) : first tergite with upper half black and lower half orange with a broad triangular stripe base upwards ; second tergite orange with a broad black median stripe, the upper end spreading out a little along the margin, edged with indistinct silvery stripes, and with marginal yellowish white patches ; third tergite with a similar median stripe edged with silvery stripes, clove brown admedian stripes and silvery margins ; fourth tergite similar but all stripes narrower.

Female.—Front very wide, almost equal to that of an eye ; frontal stripe very broad, black (brownish in immature specimens), almost half the width of an eye ; parafrontals broad below but narrowing towards the vertex, dark bluish above, greyish below, at middle about a quarter the width of the frontal stripe ; cheeks either silvery or yellow.

Four thoracic stripes, broad, about half the width of the frontal stripe, complete, the median pair often narrower than the external pair,

Abdomen (Pl. XXXII, fig. 27): first tergite usually entirely dark orange, often appearing black, sometimes the first tergite is not unlike that of the male; second tergite greyish yellow, often with a bluish sheen in fresh specimens, narrow to broad median black stripe and narrow to broad admedian black stripes spreading out along lower border of tergite; third tergite similar but median and admedian stripes narrower; fourth tergite greyish yellow with faint admedian dark stripes.

Specimens of this species have been sent us by Dr. Prashad from Kashmir, (Gandarbul, 6000 ft.), collected in June, and by Mr. Bainbrigge Fletcher from Kumaon, (Muktesar, 7000 ft.)

The male can be recognized by the wide front, almost half that of an eye, and the female by the characteristic parafrontals narrowed at the vertex. There are only a few hairs on vein R_{4+5} on the ventral side near the base, never extending outwards, and there is only one hair on the root of the radial vein.

2. *Musca vicina Macquart (*nec* R.-D.)

* *Musca flavinervis* Thoms.; * *Musca flavifacies* Big.; * *Musca flavipennis* Big.; ? *Musca analis* Macq.; ? *Musca divaricata* Awati.

Male.—Front less than one-fifth that of an eye and less than half that of the front of *domestica.* In other respects similar to that species.

Abdomen (Pl. XXX, fig. 2): first and second tergites lighter orange; tergites iii and iv lighter than those of *domestica.*

Female.—Very similar to the female *domestica,* but parafrontals not narrowed to the same extent.

Abdomen (Pl. XXXII, fig. 28); first and second tergites much more orange than in *domestica.*

This species is one of the commonest in the Orient and is widely distributed even at high altitudes. One of the writers has examined many hundreds of specimens of *M. domestica* from different localities in Great Britain but has never yet seen this species. It first appears in the Palaearctic Region in the Mediterranean area.

The male can easily be distinguished from the male of *domestica* by the narrower front, the female is however difficult to distinguish from the female of that species.

3. Musca nebulo F.

* *Musca determinata* Wlk. *nec Patton*; ? *Musca multispina* Awati.

Male.—Front narrow, about one-sixth to one-seventh the width of an eye and less than a quarter that of the male *domestica,* cheeks silvery, sometimes yellow.

Four thoracic stripes, broad, parallel, twice as broad as front, complete.

Abdomen (Pl. XXX, fig. 3): first tergite light orange, anterior border black, with black median stripe; second tergite light orange with a

broader median black stripe edged with well marked silvery stripes, and silvery marginal spots; third segment similar, the median stripe narrower; fourth tergite with a median dark area never forming a complete stripe.

Female.—Front wide but considerably less than that of an eye; frontal stripe about one-fifth that of front; parafrontals greyish except vertex, which is dark.

Thoracic stripes similar to those of male. Ground colour of thorax light grey.

Abdomen (Pl. XXXII, fig. 29); first tergite light orange, the middle of the anterior border black, no complete median dark stripe, but always with a dark spot at middle of posterior border of tergite; second tergite silvery with a median black stripe and dark brown admedian stripes, the marginal area often with a bluish tinge; third tergite similar but with the median dark stripe narrower; fourth tergite mainly silvery with some brown patches.

This species is widely distributed throughout the Oriental Region; in India it is common in some of the hill stations. It is the important bazaar fly and swarms on all food stuffs.

4. *Musca yerburyi* Patton.

* *Musca incerta* Patton *nec* Wlk.

Male.—Front very narrow, about one-twelfth an eye.

Thorax with four dark stripes, the ground colour with a bluish tinge.

Abdomen (Pl. XXX, fig. 4); first tergite orange, the anterior border black, the median stripe often incomplete, but always a dark spot in middle of the posterior border; second tergite bright orange with a broad median black stripe extending a little along the anterior margin, edged with well marked silvery stripes, *the margins of tergite always without any silvery spot or stripe;* third tergite with a narrower median stripe, edged with silvery stripes as on preceding segment, broad dark brown admedian stripes and silvery margins, fourth tergite with a variable dark median patch and narrow to very narrow admedian stripes and silvery margins.

Female.—Front about half the width of an eye.

Thorax as in male.

Abdomen (Pl. XXXII, fig. 30); first tergite similar to that of male; second also similar but always with marginal silvery spots; third tergite similar to second; fourth with a narrow, somewhat incomplete, median dark stripe and silvery margins.

This species is widely distributed in South India and is mainly a bazaar fly. The male can be distinguished from *nebulo* by noting that there are never marginal silvery spots on the second tergite. If there is still any doubt in separating the species it should be noted that the thorax is always darker than in *nebulo*; the silvery stripe on each side of the median black stripe on tergites ii and iii is also very characteristic.

5. *Musca sorbens* Wied.

* *Musca humilis* Wd.; * *Musca spectanda* Wd.; * *Musca latifrons* Wd.; * *Musca mediana* Wd.; * *Musca angustifrons* Thoms.; * *Musca bivittata* Thoms.; * *Musca sordidissima* Wlk.; * *Musca eutaeniata* Big.; *Musca scapularis* Rond.; * *Musca dichotoma* Bezzi; * *Musca biseta* Hough.; *Musca conducens* Patt. *nec* Wlk.; ?*Musca promisca* Awati.

Male.—Front narrow, one-sixth to one-eighth an eye.

Two broad thoracic stripes not interrupted at suture.

Abdomen (Pl. XXX, fig. 5): first tergite either light or dark brown; if only dark along anterior border, there are usually two well marked admedian brown spots; second tergite with dark brown median stripe spreading out along the anterior border of the tergite to fuse with the dark area of first tergite, edged with broad silvery stripes and with silvery marginal spots; third tergite with a narrower dark median stripe, edged with silvery stripes and with marginal spots; fourth tergite with narrow dark median stripe, narrow dark brown admedian stripes and marginal silvery patches.

Female.—Front about equal to an eye in width. Frontal stripe narrow with straight sides; parafrontals wide, equal to about half the width of the frontal stripe at middle, grey; cheeks grey.

Two thoracic stripes divided in front of the suture.

Abdomen (Pl. XXXII, fig. 31); first tergite black; second tergite with wide black median stripe widening out anteriorly and posteriorly, edged with bluish white spots, broad admedian dark brown to black stripes widening out anteriorly and posteriorly, and marginal greyish yellow spots; third tergite similar, the median stripe narrower, the admedian spots varying in width according to the angle at which the specimen is held; fourth tergite with narrow dark median stripe and indistinct dark admedian ones.

Musca sorbens is one of the most widely distributed subtropical and tropical house and bazaar flies. As it breeds in cow dung as well as in horse and human excreta it is common to find it on cattle and horses far from human dwellings. The female deposits its eggs in patches of cow dung in the field and it is common to find large numbers of its larvae in very small patches of dung. Many of these larvae fail to become full grown and as a result pupate prematurely and hundreds of small specimens of adults hatch out of such puparia. These small specimens are extremely persistent in the way in which they settle on the human body searching for sweat or exudations from cuts, sores, etc. They are also common on animals behaving much as do the species of Group II (Hæmatophagous species). It is quite common to see large numbers sitting round the eyes of small children, feeding on any discharge from the eye. *M. sorbens* is therefore an important carrier of the bacteria of eye diseases.

This species is also abundant on human food especially when exposed for sale in bazaar shops. It is therefore of very peculiar interest as it links up the true house frequenting species such as *nebulo* and *vicina* with those of Group II which are only found on animals.

M. sorbens is easily distinguished from the next species by its greyer thorax, and in the male by its wider front.

6. *Musca vetustissima Wlk.

? *Musca pumila* Macq.; **Musca niveisquama* Thoms.; *Musca humilis auctt. nec* Wied.; *Musca corvina* Froggatt *nec* F.; *Musca minor* Patton *nec* Macq.

Male.—Front very narrow, about one-twelfth an eye.

Thorax with two very broad black stripes, the ground colour bluish grey.

Abdomen (Pl. XXX, fig. 6): first tergite black; second orange with a broad black median stripe, broadly edged silvery, and with marginal silvery spots which often coalesce with the silvery stripes forming a white band as shown in figure; third tergite with a narrower median black stripe edged with broad silvery stripes, and with broad silvery marginal spots, posterior margin often with a narrow dark brown posterior band; fourth tergite with a median dark area and silvery marginal spots.

Female.—Front wide, nearly equal to an eye in width. Parafrontals steel grey.

Thorax with two broad black stripes divided in front of suture. Ground colour bluish grey.

Abdomen (Pl. XXXII, fig. 32): first tergite black; second with a broad black median stripe, broad black posterior band, narrow black admedian stripes and remainder of segment bluish grey; third tergite similar but stripes narrower and either with or without a black posterior band; fourth tergite with median dark area and silvery margins.

Musca vetustissima is widely distributed in the Oriental Region and breeds mainly in human excreta, its habits are similar to those of *sorbens*. In Australia it is known as the "camp" or "bush fly," and in that Continent takes the place of *sorbens*.

7. **Musca vitripennis** Meig.

* *Musca osiris* Wd.; ? *Musca sugillatrix* R.-D.; ? *Musca phasiaeformis* Meig.

Male.—Front about one-tenth width of eye. Eyes densely pubescent. Thorax dark metallic green without any stripes.

Abdomen (Pl. XXX, fig. 7): first tergite orange with a broad dark metallic green area; second brown with a broad dark green median stripe; third with a large greyish patch occupying middle of tergite and a small median spot near posterior border; fourth almost entirely greyish with some metallic sheen, and small brown spots at lower margins.

Female.—Front slightly wider than an eye; frontal stripe narrow, black, about one-third width of front; parafrontals wide, grey, metallic at vertex; cheeks grey.

Four dark thoracic stripes; admedian pair narrow, complete; outer pair forming a dark spot in front of suture, behind it indistinct and tending to merge into the admedian stripes; ground colour of thorax greyish with some metallic sheen.

Abdomen (Pl. XXXII, fig. 33): first tergite dark grey to black with some metallic sheen; second tergite grey with a broad median stripe and a black band at posterior margin, with some metallic sheen; third tergite

dark grey with a narrow dark median stripe and metallic sheen; fourth tergite dark grey without any definite dark markings.

This species was sent to one of us by Dr. Prashad from Kashmir; a male from Baniar on cattle and a female from Kukarnag on a horse. The male can always be recognised by its densely hairy eyes, and the colour of the female is very characteristic. As elsewhere it is usually found on or near animals. It breeds in cow and horse dung.

8. **Musca tempestiva** Fallen.

Musca cuprea Macq.; ? *Musca nana* Meig.

Male.—Front very narrow.

Thorax black with some metallic sheen.

Abdomen (Pl. XXX, fig. 8): first tergite all black; second grey with a broad median black band extending almost to middle of tergite, a narrow black band along posterior border; third tergite with a narrower black band along anterior border and a much narrower dark posterior band, with a narrow median dark stripe; fourth tergite grey, often with a dark patch about the middle not forming a definite stripe.

Female.—Front wide, equal to an eye in width. Frontal stripe black and almost half an eye in width.

Thorax grey with four narrow black stripes, inner pair well marked in front of suture, but behind it tending to merge into the outer pair.

Abdomen (Pl. XXXII, fig. 34): asin male except that the black bands on the second tergite are usually wider.

This small species was sent to one of us by Dr. Prashad from Dalchigam Rakh, Kashmir.

9. *Musca lucens** Villeneuve.

Male.—Front very narrow, eyes closely approximated in middle line. A large-lensed area present.

Thorax with two broad black stripes, united in front of the suture. Ground colour yellowish with some blue pollinosity.

Abdomen: first tergite entirely black; second yellow with a broad median black stripe extending in front to form an anterior, and behind to form a posterior band; third tergite yellow without a median stripe but with a dark posterior band; fourth tergite yellow. Sternites all black.

No bristles on vein R_{4+5} except near base.

Female.—Front almost the width of an eye. Frontal stripe about one-third width of an eye. Vertex steel blue.

Thorax: ground colour bluish with two broad black stripes, which in one specimen seen are divided anterior to the suture.

Abdomen: first tergite light brown, unmarked; second similar with blue pollinosity; third similar. Sternites black.

Re-described from specimens from Ceylon, (Trincomali and Haragam) in British Museum, (Yerbury), which we believe to be Villeneuve's *lucens*.

10. *Musca albina* Wied.

* *Musca speculifera* Bezzi ; *Musca beckeri* Schnabl.

Male.—Eyes well separated.

Thorax dark metallic without any stripes.

Abdomen yellow ; first tergite with a dark median spot on posterior border ; a similar spot on second and third tergites ; fourth tergite with a silvery patch.

Female.—Front very wide, equal to width of an eye ; frontal stripe very narrow ; parafrontals wide with four rows of bristles.

Thorax silvery with four black stripes.

Abdomen (Pl. XXXII, fig. 35) : first tergite yellow with a dark posterior band, which may only be limited to the middle of the posterior border ; second tergite silvery with a broad black median stripe and a black posterior band.

We have seen a single female of this species from Baluchistan, in the Indian Museum collection, and several specimens of both sexes in Col. Yerbury's collection from Ceylon now in the British Museum. The male is very like the male of *lucidula*, and as they both occur in Egypt *lucidula* can only be distinguished from *albina* by the presence of sternopleural bristles, which are always absent in *albina*. In a recent paper Bezzi has erected the genus *Lissosterna* for this species.

11. *Musca pulla* Bezzi.

* *Musca craggi* Patton.

Male.—Front narrow, one-seventh to one-eighth that of an eye.

Thorax with four black stripes, the inner pair always much narrower than the external in front of the suture.

Abdomen (Pl. XXX, fig. 9) : first tergite dark brown to black ; second brown with a broad median black stripe expanded below and spreading out a little along the middle of the anterior border, edged with indistinct silvery spots and with a large yellowish white marginal spot ; third tergite brown with a narrower median black stripe, edged with silvery spots, the posterior border of the tergite with a narrow dark band.

Female.—Front wide, about equal to that of an eye ; frontal stripe about equal to half of this.

Thorax with four black stripes as in the male, the inner pair narrower than the outer in front of the suture.

Abdomen (Pl. XXXII, fig. 36) : first tergite dark brown to black ; second tergite brown with a dark median stripe, a dark band along the posterior border and also along the anterior border, the former usually the broader with well marked marginal yellowish spots ; third tergite similar but stripes and bands narrower.

This species is widely distributed in parts of Ceylon and South India. It can readily be recognized by the narrow presutural inner thoracic stripes. Bezzi first recorded it from East Africa.

12. *Musca ventrosa* Wied.

* *Musca xanthomela* Wlk.; * *Musca pungoana* Karsch ; * *Musca nigrithorax* Stein ; *Musca kasauliensis* Awati.

Male.—Front very narrow, eyes narrowly separated.

Thorax with four broad black stripes on a dark bluish grey ground ; in some lights the thorax appears of a uniform shining black colour.

Abdomen (Pl. XXX , fig. 10) : orange throughout without any definite bands or stripes ; sometimes there is a faint dark median stripe on the second and third tergites as shown in the figure.

Female.—Front a little more than half the width of an eye.

Thoracic and abdominal markings similar to those of male. The figure of the abdomen (Pl. XXXII, fig. 37) shows an appearance commonly encountered, with dark semi-digested blood showing in the gut through the tergite wall.

This characteristic species with its dark thorax and orange abdomen is widely distributed in the Oriental Region. It is commonly seen flitting about on cattle and horses.

13. ***Musca villeneuvi** Patton.

Male.—Front very narrow with eyes closely approximated.

Thorax with two broad black stripes ; the light bluish grey median presutural stripe is well marked.

Abdomen (Pl. XXX, fig. 11) : first tergite brown, its upper border black with an indistinct and incomplete median dark stripe ; second tergite brown with a broad black median stripe expanding T-shape along the anterior border, edged with silvery patches, with marginal yellowish white spots, lower border with a very narrow dark band ; third tergite similar but the median black stripe narrower, and lower border with a wider dark band ; fourth tergite brown with a very narrow dark median stripe, edged with silvery stripes and marginal spots or patches.

Female.—Front about half the width of an eye.

Thorax with two very broad black stripes as in male.

Abdomen (Pl. XXXII, fig. 38) : with markings similar to those of the male except that the abdomen is darker brown.

The original specimens of this species were collected on elephant dung at Nilambur, South India. We have since seen a specimen from Ootacamund in the Pusa collection. It can be readily recognized by the two broad black thoracic stripes, which are not divided in front of the suture.

14. ***Musca dasyops** Stein.

Male.—Front narrow, eyes densely hairy.

Thorax blackish with two broad black stripes.

Abdomen : first tergite black with two greyish admedian spots on the posterior border ; second tergite with a broad median black stripe black admedian stripes forming a posterior black band with the median stripe, intervening areas and margins greyish.

Female.—Front wide ; eyes densely hairy.

Thorax and abdomen similar to those of male except that the whole of the first tergite is black. (Pl. XXXII, fig. 39).

Recorded from Africa, Mount Kilimandjaro ; and China.

15. *Musca gibsoni* Patton & Cragg.

? *Musca latiparafrons* Awati.

Male.—Front narrow, eyes closely approximated, with scanty small hairs.

Thorax with four broad black stripes.

Abdomen (Pl. XXX, fig. 12) : first tergite dark brown, the sides and posterior border orange, and with a large dark brown median stripe; second tergite orange with a broad black median stripe, adjacent silvery stripes and silvery marginal spots; third tergite similar but median stripe narrower and admedian dark stripes well marked and forming an almost complete dark posterior band.

Female.—Front broad, parafrontals greyish yellow, bluish at vertex. Eyes finely hairy under a high power.

Thorax similar to that of male.

Abdomen (Pl. XXXII, fig. 40) : first tergite orange, anterior and posterior margins black and with a broad black median stripe sometimes incomplete; second tergite with a narrower median dark stripe spreading out widely along the anterior border of the segment, dark admedian stripes and silvery marginal spots; third tergite similar but the dark stripes much narrower and the intervening and marginal spots yellowish white.

This species is widely distributed in South India at elevations of 4,000 ft. upwards. We have also seen specimens from Sikkim and N. E. Assam, (Dibrugarh), in the Indian Museum collection. It is only found on and near animals and breeds in patches of cowdung dropped in the field.

16. *Musca pattoni* Aust.

Male.—Front very narrow, eyes closely approximated.

Thorax with four broad black stripes.

Abdomen (Pl. XXX, fig. 13) : first tergite light orange, the anterior border black with a narrow black median stripe; second tergite with a broader median black stripe, edged with broad silvery yellowish white patches and with marginal white spots; third tergite with a narrower median dark stripe, otherwise similar to second.

Female.—Front almost the width of an eye.

Thorax similar to that of male.

Abdomen (Pl. XXXII, fig. 41) : first tergite orange with anterior margin black and with or without a narrow dark median stripe, a dark median patch on the posterior border forming an incomplete band; second tergite with a broad black median stripe somewhat T-shape anteriorly, edged with well marked broad silvery stripes and marginal spots, intervening areas forming narrow dark admedian stripes widening out posteriorly to form incomplete brown bands; third tergite similar but the median black stripe narrower.

Musca pattoni is widely distributed in India, Burma and Ceylon, and is common on animals in the field and about cowdung.

It is closely allied to *M. spinohumera* and can only be distinguished by noting the following characters :—the eyes of the male are narrowly separated whilst those of the male *spinohumera* are well separated.

The first tergite of the male abdomen in *spinohumera* has a broader black median area. The root of the radial vein has from one to three hairs whilst in *spinohumera* it has from five to seven. It should be noted that in both species vein R_{4+5} has a row of small bristles on its ventral side extending up to and beyond the radio-medial cross vein.

Musca pattoni is oviparous and deposits a stalked egg; *M. spinohumera* is larviparous.

17 **Musca spinohumera** Awati.

Male.—Front narrow, about one-eighth to one-ninth of an eye. Eyes well separated.

Thorax with four broad black stripes.

Abdomen (Pl. XXX, fig. 14): first tergite light orange with a broad median black area forming a broad black stripe; second tergite light orange with a narrower median black stripe, adjacent and marginal silvery spots; third tergite similar but median stripe much narrower.

Female.—Front wide, but distinctly less than that of an eye.

Thorax similar to that of male.

Abdomen (Pl. XXXIII, fig. 43): first tergite orange with a median black stripe and black anterior border and greyish patches on each side of the median line on the posterior border; second tergite with a black median stripe spreading out anteriorly and forming an incomplete band, admedian brown triangular stripes and silvery intervening and marginal spots; third tergite with a median dark stripe variable in its width and sometimes incomplete posteriorly, otherwise similar to second tergite.

Musca spinohumera is an uncommon species which appears to be principally confined to the Indo-Gangetic Plain. We know it from Pusa in Bihar, from Kathiawar and from Ceylon. It breeds in cow dung.

18. ***Musca xanthomelas** Wied.

Musca albomaculata auct. nec Macq.; *Musca dorsomaculata auct. nec* Macq.; *Musca convexifrons auct. nec* Thoms.

Male.—Front very narrow, eyes narrowly separated; area of large facets at middle and inner part of eye usually well marked.

Thorax with four broad black stripes.

Abdomen (Pl. XXX, fig. 15): first tergite dark brown to black; second tergite with a broad dark brown median stripe, forming a band on posterior border, admedian brown stripes and intervening and marginal silvery stripes and spots; third tergite with a much narrower median stripe edged with silvery stripes, band on posterior border much narrower.

Female.—Front wide, equal to width of an eye.

Thorax similar to that of male.

Abdomen (Pl. XXXIII, fig. 46): first tergite brown or dark brown, a broad black median stripe and a narrow posterior dark band; second tergite similar but median stripe narrower and posterior band broader third tergite similar.

The species is widely distributed in India.

19. ***Musca hervei*** Villen.

Male.—Front narrow, eyes narrowly separated, with small scanty hairs.

Thorax with four broad black stripes.

Abdomen (Pl. XXXI, fig. 16): first tergite black with admedian posterior bluish white spots; second tergite orange with broad median black stripe, brown admedian stripes and intervening and marginal silvery spots; third tergite similar but median stripe narrower. All sternites black as well as ventral margins of tergites, suggesting the appearance of a line enclosed in brackets.

Female.—Front wide, equal the width of an eye.

Thorax and abdomen similar to that of male, tergites and sternites similarly coloured.

This species is recorded by Villeneuve from Southern China; we have seen one male from Upper Burma collected by Mr. Bainbrigge Fletcher. The Pusa collection contains a specimen from Shillong, and that of the Indian Museum a series from the Simla Hills.

20. ***Musca illingworthi*** Patton.

Male.—Front narrow, eyes narrowly separated.

Thorax with four broad black stripes.

Abdomen (Pl. XXXI, fig. 17): first tergite brown, the anterior border black and a rather diffuse dark brown patch in the middle line which may form an incomplete basal dark band; second tergite with a broad black median stripe widening out anteriorly, a broad silvery stripe on each side, triangular brown admedian stripes and marginal silvery spots; third tergite similar, but stripes narrower.

Female.—Front about half the width of an eye.

Thorax similar to that of male.

Abdomen (Pl. XXXIII, fig. 44); first tergite almost entirely black; second tergite with a narrower median and admedian stripe; third tergite similar to that of male.

So far this species is only recorded from Java, but we have also seen specimens from N. E. Assam, (Dibrugarh, and Sadiya), and from Calcutta.

21. ***Musca bakeri*** Patton.

Male.—Front narrow, eyes narrowly separated.

Thorax with four broad black stripes.

Abdomen (Pl. XXXI, fig. 18): first tergite black, (in some specimens only the anterior part is black with a black median stripe on the remainder); second tergite either light or dark brown, (the latter in the majority of specimens), with a broad black median stripe and a narrow black anterior band extending the length of the middle third of the tergite, large silvery admedian spots and silvery marginal patches; third tergite similar except that the marginal spot is larger.

Female.—Front more than half the width of an eye.

Thorax similar to that of male.

Abdomen (Pl. XXXIII, fig. 45): greyish with black stripes and bands; first tergite black with bluish grey admedian spots sometimes

extending almost the whole width of the tergite and forming a band; second tergite with a broad median black stripe and two narrow admedian ones which broaden out at the posterior border of the segment, forming a narrow posterior band, a similar band anteriorly; third tergite similar but without anterior band.

This species is only recorded at present from the Philippine Islands.

22. *Musca prashadi Patton.

Male.—Front very narrow, eyes narrowly separated.

Thorax with four broad black stripes on a rather shiny ground.

Abdomen (Pl. XXXI, fig.19): first tergite black; second orange with a broad median black stripe extending along the anterior border as a black band narrowing towards the margins, a similar but much narrower band on the posterior border of the tergite; third tergite with a narrow median dark stripe broadly edged with yellowish white spots, marginal yellow patches and intervening areas forming dark stripes.

Female.—Front wide, about equal to width of an eye; frontal stripe comparatively narrow, about one-quarter an eye width; parafrontals wide, equal to width of frontal stripe.

Thorax similar to that of male.

Abdomen (Pl. XXXIII, fig. 47): first tergite black or dark brown with yellowish grey admedian spots on posterior border, the spots sometimes extend along the lower border and form a band; second tergite yellowish grey with a dark median stripe, well marked triangular admedian stripes, their bases directed outwards and backwards; third tergite very similar, median and admedian stripes much narrower.

This species is common in Kashmir on cattle and horses at an altitude of 6000 ft.; it is related to *Musca autumnalis* but differs from it as follows:—in the male the thorax is much darker and the abdomen not nearly so brown, the front is narrower, and there are two bristles on the root of the radial vein. In the female the thoracic stripes are much narrower, and the abdomen has a characteristic olive green colour.

23. *Musca bezzii Patton & Cragg.

? *Musca pilosa* Awati.

Male.—Front very narrow, eyes narrowly separated.

Thorax with four broad black stripes.

Abdomen (Pl. XXXI, fig. 20): first tergite black except for the posterior margin on each side of the broad median black stripe being orange; second tergite with a broad median black stripe expanding T-shape for a short distance along the anterior border, with silvery edging in most specimens, white marginal spots and the intervening areas bright orange; third tergite with narrower median black stripe, broadly edged with yellowish white stripes, large marginal spots and posterior border of tergite often with a narrow band.

Female.—Front wide, but less than half an eye.

Thorax similar to that of male.

Abdomen (Pl. XXXIII, fig. 48): first tergite either entirely black or with admedian bluish grey spots near the posterior border, which may be

more extensive in extent than just small spots; second tergite with a broad black median stripe broadly edged with bluish grey spots, triangular admedian black stripes, broadening posteriorly, and marginal silvery patches; third tergite very similar but stripes narrower.

This large handsome species is widely distributed in India at altitudes of from 1,500 ft. upwards. It is common in most of the hill stations. We have seen a specimen from as far North-West as Kulu in the Indian Museum collection.

24. *Musca fletcheri, sp. nov.

Male.—Front wide, about one-third that of an eye, parafacials and cheeks silvery; palps dark brown to black; mentum strongly chitinized and bulbous.

Thorax with four broad black stripes, the inner pair ending abruptly some distance before the posterior border of the scutum. Two feebly developed presutural dorsocentral bristles and only two post-sutura's.

Abdomen (Pl. XXXI, fig. 21): first tergite mainly black, the posterior border on each side of the median black stripe narrowly yellow; second tergite yellow with a broad median black stripe narrowly edged by bluish white stripes, the median stripe spreading out along the middle of the posterior border forming a narrow band; third tergite similar but with very narrow median black stripe and dark orange admedian triangular spots posteriorly; fourth tergite yellow. First sternite black, remainder orange. Wing with a row of bristles along the ventral side of vein R_{4+5} to well beyond the radio-medial cross vein; root of radial vein with five, sometimes with four hairs. Squamae without hairs.

Female.—Front wide, about equal to that of an eye; frontal stripe wide and bulging, about half the width of the front; parafrontals with two rows of bristles. Palps and proboscis as in male.

Thorax similar to that of male.

Abdomen (Pl. XXXIII fig. 49): first tergite mainly orange, the anterior border black, a broad median black stripe with bluish white spots on each side; second tergite grey with a narrower median dark stripe, dark brown admedian stripes widening out posteriorly; third tergite grey without any definite median stripe but a dark patch in rubbed specimens, admedian brown stripes not reaching the anterior border; fourth tergite grey with narrow admedian stripes. Wing bristles and hairs as in male. Squamae as in male.

We have much pleasure in naming this species in honour of Mr. T. Bainbrigge Fletcher, Imperial Entomologist, who sent us five males and two females taken on cattle at Samalkota; we have also found one specimen from Shencottah, Western Ghats in the Indian Museum collection. Types in the Pusa collection, co-types in authors' collections. Judging from the amount of chitinization of the mentum and the size of the prestomal teeth this species is almost certainly a biting fly. It is very closely allied to *M. inferior* but can be distinguished at once by the less heavily chitinized mentum and the absence of hairs on the dorsal surface of the squamae, which are always present in *inferior*,

25. * **Musca conducens** Wlk.

Pristirhynchomyia lineata Brun.; *Musca sorbens* Patton nec Wlk.

Male.—Front very narrow, eyes narrowly separated.

Thorax with four broad stripes, often fused especially in front of the transverse suture, the thorax then appearing to be two-striped.

Abdomen (Pl. XXXI, fig. 22); first tergite either dark brown or black, if the former the posterior lateral margins lighter orange; second tergite yellow with a narrow black median stripe extending along the anterior border to form a median band; third tergite similar but median stripe narrower.

Female.—Front about half the width of an eye; parafrontal bristles in a single row.

Thorax with four black stripes never tending to unite as in the male.

Abdomen (Pl. XXXIII, fig. 50): first tergite orange, the anterior border black, a broad median black stripe, and a narrow posterior band; second tergite grey with an olive sheen, a narrower median black stripe and a broader posterior band; third tergite similar but with a much narrower median stripe and posterior band.

This small species is widely distributed in India; it is common in Ceylon, where the male is often two-striped. The species is of peculiar interest as, though it has well developed prestomal teeth, it is unable to draw blood but can undoubtedly scratch off a scab or crust and feed on the serous fluid below.

26. ***Musca planiceps** Wied.

* *Musca cingalaisina* Big.; * *Musca pollinosa* Stein; *Philaematomyia indica* Awat i.

Male.—Front very narrow, eyes narrowly separated.

Thorax with four rather narrow dark stripes.

Abdomen (Pl. XXXI, fig. 23): first tergite yellow, the extreme anterior border black, and a narrow brown median stripe often incomplete; second tergite yellow with a narrow median lunule on anterior and posterior borders, these being sometimes joined by a faint brown stripe, triangular admedian stripes and silvery marginal spots; third tergite yellow, a dark median posterior spot which may be prolonged anteriorly but in the majority of specimens never forms a complete stripe, edged with silvery patches and a narrow dark posterior band.

Female.—Front about half an eye in width, and frontal stripe about half the width of front.

Thorax similar to that of male.

Abdomen (Pl. XXXIII, fig. 51): first tergite yellow, the anterior border in the middle line black and extending back to form a narrow dark median stripe; second tergite brown with a black or brown median spot on posterior border which may extend forward to form a complete or incomplete median stripe, silvery edging, and marginal silvery patches which may be broad and confluent in the middle of the segment leaving only brown subdorsal spots on anterior and posterior margins, posterior margin nearly always with a narrow posterior band; third tergite similar but with a narrow dark brown to black stripe, and a rather broader dark posterior band.

This species is widely distributed in India and Ceylon; it can be readily recognized by its strongly chitinized mentum and prestomal teeth, and by its yellowish golden abdomen. It is undoubtedly a blood sucker as first noted by Awati. We have so far not seen it sucking blood though we have both studied its habits in the field. It probably feeds on cattle.

27. *Musca senior-whitei Patton.

Male.—Front narrow, eyes well separated.

Thorax with four dark stripes. Ground colour slate blue.

Abdomen (Pl. XXXI, fig. 24): first tergite black with two narrow slate blue bands on each side of the median stripe and extending to the margins; second tergite slate blue with a broad black median stripe expanding T-shape at the anterior end, narrow dark brown to black admedian stripes, and silvery marginal patches; third tergite similar but median stripe narrower.

Female.—Front almost the width of an eye; frontal stripe narrow, about one-third of front.

Thorax as in male except that the stripes are narrower.

Abdomen (Pl. XXXIII, fig. 52): with markings very similar to those of male except that the blue bands on the first tergite are as a rule wider, as are also the admedian stripes on the fourth tergite.

This species is common in the Bezwada district of the Madras Presidency and also around Calcutta. We have seen a specimen from Penang in the Indian Museum collection. It also occurs in Java.

28. *Musca inferior Stein.

* *Philaematomyia gurneyi* Patton & Cragg.

Male.—Front broad, a little less than a quarter width of an eye

Thorax with four broad black stripes.

Abdomen (Pl. XXXI, fig. 25): first tergite black or dark brown with posterior admedian bluish grey spots; second tergite with a broad black median stripe, edged with broad slate blue stripes, narrow clove brown admedian stripes and broad marginal silvery spots; third tergite very similar but with a narrower black median stripe, and the admedian brown stripes extending on to the posterior border of the tergite.

Wing with bristles ventrally on vein R_{4+5} extending beyond the radio-medial cross vein; root of radial vein with four or five hairs. Squamae with hairs on the anterior border of the dorsal surface.

Female.—Front wide, about half that of an eye.

Thorax similar to that of male.

Abdomen (Pl. XXXIII, fig. 53): first tergite black with a large slate blue spot on the posterior border on each side of the middle line; second tergite with a rather narrow black median stripe, broadly edged with slate blue patches, dark admedian stripes and silvery marginal patches; third tergite similar but the median stripe narrower and the admedian dark stripes produced along the posterior border.

Bristles and hairs of veins, and squamae as in male.

This striking species is the only one which has hairs on the dorsal surface of the squamae. It is widely distributed in India and is a true biting fly. One of us has bred it from patches of cowdung. It is possibly larviparous.

29. *Musca crassirostris* Stein.

Musca modesta Meij.; * *Philaematomyia insignis* Aust.

Male.—Front narrow, eyes well separated.

Thorax with four narrow black stripes.

Abdomen (Pl. XXXI, fig. 26): first tergite black, the posterior border grey with a greenish tinge; second tergite grey, a narrow median black stripe, extending along the anterior border T-shape; third tergite grey with a narrow black stripe.

Female.—Front very wide, almost equal to an eye width.

Thorax with stripes similar to those of male.

Abdomen (Pl. XXXIII, fig. 42): first tergite greyish green, the anterior border black, a narrow median black stripe either present or absent, or existing as an indefinite median black patch on the posterior border of the tergite; second tergite grey with a narrow median black stripe, and a black band on the anterior border; third tergite grey with a black band along the anterior border and an incomplete median black stripe.

This species is one of the commonest blood sucking flies of India, where it is found throughout, as also in Burma and Ceylon. It is very characteristically marked and the mentum is highly chitinized and markedly bulbous and the prestomal teeth thorn-like.